## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
## BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

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| In re Application of: )<br><br>  Zajcev et al. )<br><br>Serial No.: 10/511,811 )<br><br>Filed: October 19, 2004 )<br><br>For: A METHOD, AN APPARATUS, )<br>  A CONTROL SYSTEM AND A )<br>  COMPUTER PROGRAM TO )<br>  PERFORM AN AUTOMATIC )<br>  REMOVAL OF CATHODE )<br>  DEPOSITIONS DURING A )<br>  BIPOLAR ELECTROCHEMICAL )<br>  MACHINING )<br><br>  Confirmation No.: 6555 ) | Group Art Unit: 1795<br><br>Examiner: Nicholas A. Smith<br><br>**Board of Patent Appeals and**<br>**Interferences** |

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### APPEAL BRIEF UNDER 37 C.F.R. § 41.37

In support of the Notice of Appeal filed on June 4, 2008, and pursuant to 37 C.F.R. § 41.37, Appellants present this appeal brief in the above-captioned application.

This is an appeal to the Board of Patent Appeals and Interferences from the Examiner's final rejection of claims 1-15 in the Final Office Action dated March 19, 2008. The appealed claims are set forth in the attached Claims Appendix.

1.    Real Party in Interest

This application is assigned to Koninklijke Philips Electronics N.V., the real party in interest.

2.    Related Appeals and Interferences

There are no other appeals or interferences that would directly affect, be directly affected, or have a bearing on the instant appeal.

3.    Status of the Claims

Claims 1-15 have been rejected in the Final Office Action. The final rejection of claims 1-15 is being appealed.

4.    Status of Amendments

All amendments submitted by Appellants have been entered.

5.    Summary of Claimed Subject Matter

The present invention, as recited in independent claim 1, is directed to a method for determining an optimal mode for a removal of cathode depositions. (See Specification, p. 2, ll. 8-10). The cathode depositions being removed from an electrode during an electrochemical machining of an electrically conductive work piece in an electrolyte. (See Specification, p. 2, ll. 20-57). The cathode depositions being removed by means of applying bipolar electrical pulses between the work piece and the electrode. (See Specification, p. 1, ll. 8-10). One or more voltage pulses of an unipolar machining polarity being alternated with voltage pulses of an inverse polarity. (See Specification, p. 3, l. 31- p. 4, l. 8). While a gap between the work piece and the electrode is maintained. (See Specification, p. 1, ll. 11-12). Said gap being filled by the electrolyte. (See Specification, p. 10, ll. 5-8). Wherein during said optimal mode an optimal duration of the pulses of the inverse polarity is selected. (See Specification, p. 2, ll. 12-15, p. 6, ll. 26-29). Said optimal duration being determined from a first calibration carried out preceding the machining of the work piece and a second calibration carried out during the machining of the work piece. (See Specification, p. 3, ll. 24-26, p. 6, ll. 15-19).

The present invention, as recited in independent claim 10, is directed to a method for electrochemical machining of an electrically conductive work piece in an electrolyte by applying bipolar electrical pulses between the work piece and an electrode. (See Specification, p. 2, ll. 16-17, p. 9, l. 33 – p. 10, l. 34, Fig. 4). One or more voltage pulses of an unipolar machining polarity being alternated with voltage pulses of an opposite polarity while a gap between the work piece and the electrode in maintained. (See Specification, p. 1, ll. 11-12, p. 9, ll. 23-24). Said gap being filled by the electrolyte. (See Specification, p. 10, ll. 5-8). Wherein said method comprises the steps of: establishing an optimal pulse duration for pulses of the inverse polarity for a removal of the cathode depositions from an electrode surface during the electrochemical machining. (See Specification, p. 3, ll. 22-25). Said optimal pulse duration being determined from a first calibration carried out preceding the machining of the work piece. (See Specification, p. 5, ll. 14-15). And a second calibration carried out during the machining of the work piece. (See Specification, p. 4, ll. 13-16, p. 6, ll. 18-19). Performing a control of the machining of the work piece by means of a monitoring of an actual value of an operational parameter and comparing said actual value of the operational parameter to a preset value of the operational parameter. (See Specification, p. 6, ll. 28-31). Applying a pulse of the inverse polarity of the optimal pulse duration in case the actual value of the operational parameter is greater than the preset value of the operational parameter. (See Specification, p. 6, ll. 31-33).

The present invention, as recited in independent claim 13, is directed to a control system arranged to control an automatic removal of cathode depositions from a surface of an electrode during a bipolar electrochemical machining. (See Specification, p. 7, ll. 1-3, ). Wherein said system comprises: probing means arranged to perform a measurement of a value of an operational parameter. (See Specification, p. 11, ll. 1-4, Fig. 5). Calibration means arranged to perform a numerical calibration of a variable representative to a condition of the surface of the electrode based on the value of the operational parameter. (See Specification, p. 11, ll. 4-6). A storage unit arranged to store a dependence between the variable and a duration of an optimal inverse pulse necessary to remove said condition. (See Specification, p. 11, ll. 6-11). Monitoring means arranged to monitor an actual value of the operational parameter. (See Specification, p. 10, ll. 31-32). A logical unit arranged to compare said actual value of the operational parameter

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with a preset value of the operational parameter and to actuate an application of the optimal
pulses of inverse polarity in case the actual value of the operational parameter is greater than the
preset value of the operational parameter. (See Specification, p. 11, ll. 19-24). Parameters of the
optimal inverse pulse being determined by the calibration and the dependence stored in the
storage unit. (See Specification, p. 11, ll. 24-26).

6.    Grounds of Rejection to be Reviewed on Appeal

        I.      Whether claims 1, 10 and 13-15 are unpatentable under 35 U.S.C. §
102(e), over U.S. Pat. No. 6,558,231 to Taylor. ("Taylor") and U.S. Pat. No. 6,403,931 to Zhou
et al. ("Zhou") as incorporated by reference therein (Taylor col. 2 line 62).

        II.     Whether claims 2-9 and 11-12 are unpatentable under 35 U.S.C. § 103(a)
over U.S. Pat. No. 6,558,231 to Taylor in view of U.S. Pat. No. 5,833,835 to Gimaev et al.
("Gimaev").

7.    Argument

        I.      The Rejection Of Claims 1, 10 And 13-15 As Being Unpatentable Under 35
                U.S.C. § 102(e), Over Taylor and Zhou as Incorporated by Reference Therein
                (Taylor Col. 2 Line 62) Should Be Reversed.

        A.      The Examiner's Rejection

        In the Final Office Action, the Examiner rejected claims 1, 10 and 13-15 under 35
U.S.C. § 102(e) as anticipated by Taylor and Zhou as incorporated into Taylor by reference.
(See 3/19/08 Office Action, p. 2.)

        Taylor discloses a two-step electrochemical process for smoothing the surface of
an electrolytically dissolvable metal. (See Taylor, Abstract.) In the first step, large asperities
404 are reduced to a height comparable with those of microasperities 406. (See Taylor, col. 6, ll.
14-17; Fig. 4B.) The first step may involve pulses in the range of 0.1 microsecond to 100
milliseconds, with off-times or reverse times that may range from 10 microseconds to 500
milliseconds; the duty cycle may preferably be no greater than 50%, and more preferably less

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than 25% or even less than 10%. (See id., col. 5, ll. 41-54; Fig. 2.) The first step may typically reduce the height of macroasperities to less than about 100 μm. (See id., col. 5, ll. 33-36.) In the second step, both the original macroasperities 404 and the microsperities 406 are substantially reduced in height. (See id., col. 6, ll. 63-67; Fig. 4C.) The second step involves the use of a pulse width of at least 100 milliseconds, and preferably at least 500 milliseconds, with shorter off-times or reverse times than in the first step; the duty cycle may be greater than 50%, and is preferably greater than 75% or even 90%. (See id., col. 6, ll. 45-53; Fig. 3.) The second step may reduce the final roughness of the surface to 0.1 μm or less. (See id., col. 6, ll. 35-37.)

B.     The Cited Patents Do Not Disclose Wherein During Said Optimal Mode An Optimal Duration Of The Pulses Of The Inverse Polarity Is Selected, Said Optimal Duration Being Determined From A First Calibration Carried Out Preceding The Machining Of The Work Piece And A Second Calibration Carried Out During The Machining Of The Work Piece, As Recited In Claim 1.

Claim 1 recites "[a] method for determining an optimal mode for a removal of cathode depositions from an electrode during an electrochemical machining of an electrically conductive work piece in an electrolyte by means of applying bipolar electrical pulses between the work piece and the electrode, one or more voltage pulses of an unipolar machining polarity being alternated with voltage pulses of an inverse polarity while a gap between the work piece and the electrode is maintained, said gap being filled by the electrolyte, *wherein during said optimal mode an optimal duration of the pulses of the inverse polarity is selected, said optimal duration being determined from a first calibration carried out preceding the machining of the work piece and a second calibration carried out during the machining of the work piece.*"

Taylor describes a process with a first step of the reducing macroasperities in height until they become microasperities. (See Taylor, col. 3, ll. 25-37). Taylor employs pulsed current with a pulse width from 0.1 microseconds to about 100 milliseconds. (See Taylor, col. 3, ll. 40-42). Taylor describes a second step once the macroasperities have been reduced in height to produce a microprofile regime at the substrate level. (See Taylor, col. 4, ll. 18-23). The pulse width of the second step should be at least 100 millisecond. (See Taylor, col. 4, ll. 45-47). While Taylor describes a two step process, each process is independent. The pulse widths of the first

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and second steps are only generally defined. However, there is no discussion of a calibration, let alone multiple instances of calibration.

Thus, Appellants respectfully submit that Taylor contains neither a determination of an optimal pulse duration, nor disclosure that said optimal pulse duration should be determined based on a first calibration carried out prior to machining and a second calibration carried out during machining. Zhou also does not disclose any such determination. Moreover, the Examiner failed to assert that either Taylor or Zhou disclosed such a determination in either the Non-Final Rejection or the Final Rejection. (See 9/19/07 Office Action, pp. 2-3; 3/19/08 Office Action, p. 2.) Rather, the Examiner cited the two-step method disclosed by Taylor, using the underlying technique described by Zhou, which differs from the recitation of claim 1. Accordingly, Appellants respectfully request the Board overturn the Examiner's rejection of claim 1.

Claim 10 recites "[a] method for electrochemical machining of an electrically conductive work piece in an electrolyte by applying bipolar electrical pulses between the work piece and an electrode, one or more voltage pulses of an unipolar machining polarity being alternated with voltage pulses of an opposite polarity while a gap between the work piece and the electrode in maintained, said gap being filled by the electrolyte, wherein said method comprises the steps of: *establishing an optimal pulse duration for pulses of the inverse polarity for a removal of the cathode depositions from an electrode surface during the electrochemical machining, said optimal pulse duration being determined from a first calibration carried out preceding the machining of the work piece and a second calibration carried out during the machining of the work piece*; performing a control of the machining of the work piece by means of a monitoring of an actual value of an operational parameter and comparing said actual value of the operational parameter to a preset value of the operational parameter; applying a pulse of the inverse polarity of the optimal pulse duration in case the actual value of the operational parameter is greater than the preset value of the operational parameter."

Appellants respectfully submit that Taylor and Zhou (as incorporated into Taylor by reference) do not disclose "establishing an optimal pulse duration for pulses of the inverse

polarity for a removal of the cathode depositions from an electrode surface during the electrochemical machining, said optimal pulse duration being determined from a first calibration carried out preceding the machining of the work piece and a second calibration carried out during the machining of the work piece," as recited in claim 10, for the reasons discussed above with reference to claim 1. Accordingly, Appellants respectfully request the Board overturn the Examiner's rejection of claim 10 for at least the same reasons as claim 1.

Claim 13 recites "[a] control system arranged to control an automatic removal of cathode depositions from a surface of an electrode during a bipolar electrochemical machining, wherein said system comprises: probing means arranged to perform a measurement of a value of an operational parameter; calibration means arranged to perform a numerical calibration of a variable representative to a condition of the surface of the electrode based on the value of the operational parameter; a storage unit arranged to store a dependence between the variable and a duration of an optimal inverse pulse necessary to remove said condition; monitoring means arranged to monitor an actual value of the operational parameter; *a logical unit arranged to compare said actual value of the operational parameter with a preset value of the operational parameter and to actuate an application of the optimal pulses of inverse polarity in case the actual value of the operational parameter is greater than the preset value of the operational parameter, parameters of the optimal inverse pulse being determined by the calibration and the dependence stored in the storage unit.*"

Appellants respectfully submit that Taylor and Zhou (as incorporated into Taylor by reference) do not disclose "a logical unit arranged to compare said actual value of the operational parameter with a preset value of the operational parameter and to actuate an application of the optimal pulses of inverse polarity in case the actual value of the operational parameter is greater than the preset value of the operational parameter, parameters of the optimal inverse pulse being determined by the calibration and the dependence stored in the storage unit," as recited in claim 13, for the reasons discussed above with reference to claim 1. Accordingly, Appellants respectfully request the Board overturn the Examiner's rejection of claim 13 for at least the same reasons as claim 1. Because claims 14 and 15 depend from, and, therefore, include all of the limitations of claim 1, Appellants respectfully submitted that these claims are

also allowable for at least the same reasons. Accordingly, Appellants respectfully request that the Board overturn the Examiner's rejection of claims 14 and 15.

II.     The Rejection of Claims 2-9 and 11-12 Under 35 U.S.C. § 103(a) Over Taylor In View Of Gimaev Should Be Reversed.

A.     The Examiner's Rejection

In the Final Office Action, the Examiner rejected claims 2-9 and 11-12 under 35 U.S.C. § 103(a) as being unpatentable over Taylor in view of Gimaev. (See 3/19/08 Office Action, pp. 2-3.)

Gimaev discloses a method wherein the amplitude of pulses used to machine a workpiece is altered between two predetermined values. (See Gimaev, Abstract.)

B.     The Cited Patents Do Not Disclose Wherein During Said Optimal Mode An Optimal Duration Of The Pulses Of The Inverse Polarity Is Selected, Said Optimal Duration Being Determined From A First Calibration Carried Out Preceding The Machining Of The Work Piece And A Second Calibration Carried Out During The Machining Of The Work Piece, As Recited In Claim 1.

Claim 1 recites "[a] method for determining an optimal mode for a removal of cathode depositions from an electrode during an electrochemical machining of an electrically conductive work piece in an electrolyte by means of applying bipolar electrical pulses between the work piece and the electrode, one or more voltage pulses of an unipolar machining polarity being alternated with voltage pulses of an inverse polarity while a gap between the work piece and the electrode is maintained, said gap being filled by the electrolyte, *wherein during said optimal mode an optimal duration of the pulses of the inverse polarity is selected, said optimal duration being determined from a first calibration carried out preceding the machining of the work piece and a second calibration carried out during the machining of the work piece.*"

Appellants respectfully submit that Gimaev does not disclose the determination of an optimal pulse duration. Therefore, Gimaev fails to cure the deficiencies of Taylor discussed

above with reference to claim 1. Accordingly, Taylor and Gimaev, alone or in combination, neither disclose nor suggest "wherein during said optimal mode an optimal duration of the pulses of the inverse polarity is selected, said optimal duration being determined from a first calibration carried out preceding the machining of the work piece and a second calibration carried out during the machining of the work piece," as recited in claim 1. Because claims 2-9 depend from, and, therefore, include all of the limitations of claim 1, Appellants respectfully submitted that these claims are also allowable for at least the same reasons. Accordingly, Appellants respectfully request that the Board overturn the Examiner's rejection of claims 2-9.

Similarly, Taylor and Gimaev, alone or in combination, neither disclose nor suggest "establishing an optimal pulse duration for pulses of the inverse polarity for a removal of the cathode depositions from an electrode surface during the electrochemical machining, said optimal pulse duration being determined from a first calibration carried out preceding the machining of the work piece and a second calibration carried out during the machining of the work piece," as recited in claim 10. Because claims 11 and 12 depend from, and, therefore, include all of the limitations of claim 10, Appellants respectfully submit that these claims are also allowable for at least the same reasons. Accordingly, Appellants respectfully request that the Board overturn the Examiner's rejection of claims 11-12.

## Conclusion

For the reasons set forth above, Appellants respectfully request that the Board reverse the rejection by the Examiner of claims 1, 10 And 13-15 under 35 U.S.C. § 102(e), claims 2-9 and 11-12 under 35 U.S.C. § 103(a) and indicate that claims 1-15 are allowable.

Respectfully submitted,

Date:   July 29, 2008

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## CLAIMS APPENDIX

1.      (Previously Presented) A method for determining an optimal mode for a removal of cathode depositions from an electrode during an electrochemical machining of an electrically conductive work piece in an electrolyte by means of applying bipolar electrical pulses between the work piece and the electrode, one or more voltage pulses of an unipolar machining polarity being alternated with voltage pulses of an inverse polarity while a gap between the work piece and the electrode is maintained, said gap being filled by the electrolyte, wherein during said optimal mode an optimal duration of the pulses of the inverse polarity is selected, said optimal duration being determined from a first calibration carried out preceding the machining of the work piece and a second calibration carried out during the machining of the work piece.

2.      (Previously Presented) A method according to claim 1, wherein the first calibration comprises determining a dependence between a variable having a range of values corresponding to a range of heights of the cathode depositions generated on an initially clean metallic surface and a range of pulse durations of a suitable pulse of the inverse polarity necessary to remove said depositions from said surface.

3.      (Previously Presented) A method according to claim 2, wherein the first calibration comprises the steps of: performing a machining of a set of samples with unipolar machining pulses in order to yield a range of surface conditions; assigning variables characterizing the yielded surface conditions; applying a pulse of the inverse polarity having a pulse duration per sample in order to remove yielded surface conditions; performing a calibration of a dependence between the variables and the inverse pulse durations required to remove said yielded surface conditions from the samples.

4.      (Previously Presented) A method according to claim 1, wherein the second calibration comprises the steps of:
        performing a machining of the work piece by applying one or more pulses of the unipolar machining polarity until an a-priori defined condition is satisfied, said machining resulting in a first condition of a surface of the electrode;

assigning a variable characterizing the first condition of the surface of the electrode;

performing a measurement of a first value of an operational parameter representative to the first condition of the surface of the electrode;

performing an application of a pulse of the inverse polarity corresponding to the first condition of the surface of the electrode, said application resulting in a second condition of the surface of the electrode, parameters of said inverse pulse being determined from the first calibration;

performing a measurement of a second value of the operational parameter representative of the second condition of the surface of the electrode;

performing a calibration of the variable based on the first value and the second value of the operational parameter.

5.      (Previously Presented) A method according to claim 2, wherein a height of the cathode depositions is selected as the variable characterizing the surface condition of the electrode.

6.      (Previously Presented) A method according to claim 5, wherein a cathode potential is selected as the operational parameter.

7.      (Previously Presented) A method according to claim 5, wherein a region, corresponding to an interval between the unipolar machining voltage pulses, an area under a curve of the electrode potential is derived, said area being selected as the operational parameter.

8.      (Previously Presented) A method according to claim 5, wherein for short intervals between unipolar machining voltage pulses a slope of the curve of the electrode potential is derived in an interval between the unipolar machining voltage pulses, said slope being selected as the operational parameter.

9.      (Previously Presented) A method according to claim 5, wherein the absolute value of the first harmonics of the Fourier transform of a cathode potential pulse is selected as the operational parameter.

10.     (Previously Presented)  A method for electrochemical machining of an electrically conductive work piece in an electrolyte by applying bipolar electrical pulses between the work piece and an electrode, one or more voltage pulses of an unipolar machining polarity being alternated with voltage pulses of an opposite polarity while a gap between the work piece and the electrode in maintained, said gap being filled by the electrolyte, wherein said method comprises the steps of:

establishing an optimal pulse duration for pulses of the inverse polarity for a removal of the cathode depositions from an electrode surface during the electrochemical machining, said optimal pulse duration being determined from a first calibration carried out preceding the machining of the work piece and a second calibration carried out during the machining of the work piece;

performing a control of the machining of the work piece by means of a monitoring of an actual value of an operational parameter and comparing said actual value of the operational parameter to a preset value of the operational parameter;

applying a pulse of the inverse polarity of the optimal pulse duration in case the actual value of the operational parameter is greater than the preset value of the operational parameter.


11.     (Previously Presented)  A method according to claim 10, wherein a height of cathode depositions is selected as said variable.


12.     (Previously Presented)  A method according to claim 11, wherein a cathode potential is selected as the operational parameter.


13.     (Previously Presented)  A control system arranged to control an automatic removal of cathode depositions from a surface of an electrode during a bipolar electrochemical machining, wherein said system comprises:

probing means arranged to perform a measurement of a value of an operational parameter;

calibration means arranged to perform a numerical calibration of a variable representative to a condition of the surface of the electrode based on the value of the operational parameter;

a storage unit arranged to store a dependence between the variable and a duration of an optimal inverse pulse necessary to remove said condition; monitoring means arranged to monitor an actual value of the operational parameter;

a logical unit arranged to compare said actual value of the operational parameter with a preset value of the operational parameter and to actuate an application of the optimal pulses of inverse polarity in case the actual value of the operational parameter is greater than the preset value of the operational parameter, parameters of the optimal inverse pulse being determined by the calibration and the dependence stored in the storage unit.

14.    (Original) An apparatus for electrochemical machining of an electrically conductive work piece comprising the control system according to claim 13.

15.    (Original) A computer program arranged to be loaded in to a computer and to control the computer, when loaded, to function as the control system as claimed in claim 13.

## **EVIDENCE APPENDIX**

No evidence has been entered or relied upon in the present appeal.

## RELATED PROCEEDING APPENDIX

No decisions have been rendered regarding the present appeal or any proceedings related thereto.